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Climate change as a polarizing cue: Framing effects on public support for low-carbon energy policies

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ABSTRACT

This study examines how public support for four specific low-carbon energy policies (renewable energy investment, revenue-neutral carbon tax, fuel efficiency regulations, expansion of nuclear power) varies when these policies are framed as a way to reduce either climate change, air pollution, or energy dependence. A survey question wording experiment with a nationally representative U.S. sample is utilized. We find framing effects only among Republicans, whose policy support was lower in response to the climate change frame versus the air pollution and energy security frames for all policies except nuclear power. This suggests that framing effects are conditional on political partisanship and policy content. When testing the processing mechanism behind these effects, we find no evidence that the climate change frame functions as a simple heuristic; rather, the findings are consistent with motivated reasoning, whereby the framing effects on policy support are mediated by the policy's perceived relative benefits and costs.

1. Introduction

In the Pew Research Center's (2017) most recent annual survey of the U.S. public's issue priorities, of the 21 issues included, the widest partisan gap was on the importance of addressing global climate change: Just 15% of Republicans said that this should be a top governmental priority, compared to 62% of Democrats. Moreover, in studies of the drivers of belief in human-caused climate change, political identification typically outperforms all other variables in terms of their predictive power (Hornsey et al., 2016). Given these divides, scholars often point to climate change as a key marker of partisan identity in the U.S., arguing that concern about or dismissal of the threat of climate change increasingly defines what it means to be a Democrat or a Republican, respectively (Nisbet, 2009; Guber, 2017).

As a result of this polarization, amassing public support for carbon-reducing energy policies has been a challenge; yet, such support may be key to policy change (Ockwell et al., 2009). In particular, simply mentioning "climate change" may cue partisans to respond to clean energy policies in ways that are consistent with their identities – making Republicans more resistant while signaling Democrats to be more supportive. Thus, one way to build broader public support for action to address climate change may be to avoid mentioning climate change and instead emphasize alternative benefits of clean energy policies. To investigate this possibility, this study uses a question wording experiment to test how U.S. public support for four specific energy policies varies when these policies are framed as a way to address climate change or, alternatively, as a way to reduce air pollution or energy insecurity.

Although several recent studies have examined the effects of different policy justification frames on public support for climate mitigation policies (Aklin and Urpelainen, 2013; Bernauer and McGrath, 2016; Lockwood, 2011; McCright et al., 2016; Mossler et al., 2017; Petrovic et al., 2014; Stokes and Warshaw, 2017; Walker et al., 2017), the results have been mixed, likely due to inconsistencies in sample, design, and measurement, thus signaling a need for additional research. This study builds on this literature in several specific ways. We study a nationally representative U.S. sample recruited from YouGov and, to our knowledge, are the first to test energy security as an alternative benefit frame with a U.S. audience. Existing studies also have not systematically compared framing effects across different policies. In this study, we compare framing effects between four specific policies that appeal differently across the political spectrum: fuel efficiency regulations, investment in renewable energy, expansion of nuclear power, and a revenue-neutral carbon tax. By examining specific policy proposals, we are able to understand more clearly how partisan identity in the context of the two-party U.S. system interacts with framing to influence public support for clean energy policies.

Additionally, questions remain as to the processing mechanism via

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which a climate change frame may polarize opinions (Kahan et al., 2017, p. 23). On one hand, "climate change" may serve as a simple heuristic (Lau and Redlawsk, 2001), cueing partisans to intuitively accept or reject a policy based on its association with climate change. Alternatively, a climate change frame may trigger motivated reasoning (Taber and Lodge, 2006), whereby people's reaction toward climate change shapes their systematic processing of policy content – in terms of its perceived relative benefits and costs – which, in turn, drives their policy support. This study offers a test of these alternative mechanisms by examining whether the climate change frame prompts heuristic processing, measured via response latencies, or whether framing effects on policy support work through perceived benefits and costs.

Our findings show that the climate change frame does, indeed, result in more polarization between Democrats and Republicans; however, framing effects are confined to Republicans, who show reduced support for low-carbon energy policies when the policies are presented as a solution for climate change versus as a solution for air pollution or energy dependence. These effects are observed only for the fuel efficiency, renewables, and carbon tax policies – not nuclear power, suggesting important differences in framing effects between policies. There is no evidence that the climate change frame functions as a simple heuristic; rather, framing effects on policy support are mediated by the policy's perceived relative benefits and costs.

1.1. Framing low-carbon energy policy

Scientists and policymakers have recommended a portfolio of energy-based solutions to help reduce greenhouse gas emissions and mitigate climate change, including investment in nuclear power and in renewables such as solar and wind, regulation of emissions from power plants and the transportation sector, and market-based approaches such as carbon pricing (Bertram et al., 2015; IPCC et al., 2014; Jacoby et al., 2014; Veerapen and Beerepoot, 2011). Public support for these approaches will play a key role in transforming the U.S. energy system away from fossil fuels and toward low-carbon sources that are critical for climate change mitigation. Importantly, these energy policies have implications not only for mitigating climate change but also for reducing air pollution and its related health effects, as well as for helping to free the U.S. from dependence on foreign energy sources. These co-benefits of low-carbon energy policies offer alternative solution justifications and, as such, function as frames that may differentially activate values so as to promote a certain interpretation of the solution itself (Entman, 1993).

Broadly, framing refers to the process via which a communication message, by emphasizing particular aspects of an issue over others, shapes people's interpretation of that issue (Druckman, 2001; Entman, 1993). Numerous studies across multiple contexts have shown that shifting how an issue is framed – even through small changes in message wording – can alter the public's support for policies (e.g., Gollust et al., 2013; Hurwitz and Peffley, 2005; Kinder and Sanders, 1990; Nelson et al., 1997; Simon and Jerit, 2007). According to Price and Tewksbury (1997), framing works by "activating certain constructs which then have an increased likelihood of use in evaluations made in response to the message" (p. 197). In other words, frames suggest to message recipients that particular considerations are applicable to evaluating the issue at hand; individuals then use these considerations to make sense of the issue and reach a judgment.

Thus, in the present context, framing a particular energy policy as a solution to climate change, for example, makes climate change relevant to evaluating that policy. Given the U.S. public's divisiveness on climate change, applying climate change to an evaluation of a policy is likely to result in more polarized opinions between Democrats and Republicans than using an alternative frame for which there is greater partisan agreement. All else equal, individuals should be more supportive of a policy when its purported benefits cohere with their values and interests. In this study, we focus on reduction in air pollution and energy security, respectively, as alternatives to a climate change frame. This follows prior research that found that the health benefits of climate mitigation resonate across the political spectrum (Maibach et al., 2010) and that conservatives and Republicans perceive health benefits and energy security as more compelling reasons than climate change for reducing fossil fuel use (Gromet et al., 2013; Maibach et al., 2013; Petrovic et al., 2014).

Several recent studies have examined how emphasizing alternative benefits of clean energy policy affect public support. On balance, these studies offer evidence for framing effects (but see Bernauer and McGrath, 2016) and taken together, suggest several key conclusions. First, emphasizing reductions to air pollution and health risks increases support for clean energy policies, particularly among Republicans and others predisposed to climate skepticism (Mossler et al., 2017; Petrovic et al., 2014; Stokes and Warshaw, 2017; Walker et al., 2017). Just one study (Lockwood, 2011), conducted in the United Kingdom, tested the effects of an energy security frame, finding that it increased support for expanding renewable energy among conservatives relative to a climate change frame. In the U.S., Aklin and Urpelainen (2013) found that the effects of a positive energy security frame on support for clean energy policy were diluted in the presence of a negative counter-frame; however, this study did not explicitly compare the energy security frame to alternative benefit frames, nor did it examine interactions with partisan identity. Thus, in the U.S., an energy security frame has yet to be directly tested as an alternative to a climate change frame, despite its prominence in U.S. political discourse (Vezirgiannidou, 2013), as well as evidence, noted above, that right-leaning publics see energy security as an important reason to reduce fossil fuel use (Gromet et al., 2013; Maibach et al., 2013).

Evidence for framing effects among Democrats and liberals is more mixed. Petrovic et al. (2014) found that liberals were more supportive of national policies to reduce air pollution when air pollution was linked to climate change concerns rather than to public health concerns. However, a study with students in the UK found that all respondents – regardless of political orientation – responded more negatively to a proposed car use reduction policy when it was framed as a way to address climate change versus public health (Walker et al., 2017). Still other studies found no evidence of framing effects among Democrats (Stokes and Warshaw, 2017). This latter finding may be due to a ceiling effect, such that Democrats are already quite supportive of many low-carbon energy policies and are thus not responsive to framing (Mossler et al., 2017).

Other studies, outside the context of energy policy, also point to climate change as a polarizing cue (Carrico et al., 2015; Hine et al., 2016; Kahan et al., 2017). For example, Hine et al. (2016) found that Australians dismissive of climate change were most responsive to climate adaptation messages when they did not mention climate change.

Based on this prior theory and research, we predict the following:

H1. Framing will interact with partisan identity such that Republicans [Democrats] will be less [more] supportive of low-carbon energy policies when they are framed as a way to address climate change versus as a way to reduce air pollution or energy insecurity.

In addition to how a policy is framed, the compatibility of the proposed policy solution with one's partisan identity also may affect public support and the level of opinion polarization among political partisans. That is, policies themselves are not ideologically neutral but carry information that resonates with different political value orientations. For example, regulatory policies commonly proposed as solutions to climate change are viewed as threats to Republican principles of free markets and limited government (Campbell and Kay, 2014). At the same time, Democrats have long opposed nuclear power due to concerns about environmental and health dangers, whereas Republicans are less sensitive to these risks and see the growth of nuclear technology as a symbol of industrial prowess and free market ideals (Jenkins-Smith et al., 2011; Peters and Slovic, 1996; Rothman and Lichter, 1987).

Despite the potential for conditional framing effects that are dependent on specific types of policy proposals, prior framing studies tend to focus either on unspecified, general climate mitigation or emissions reduction policies as a dependent variable (Bernauer and McGrath, 2016; Mossler et al., 2017; Petrovic et al., 2014) or on just one specific policy, such as a renewable portfolio standard (Stokes and Warshaw, 2017) or car use reduction (Walker et al., 2017). Thus, existing research does not offer an opportunity to observe how framing effects may vary across different policies based on their ideological content. For example, given the potential for ceiling effects among left-leaning citizens (Mossler et al., 2017), framing may have a stronger influence for policies that Democrats are predisposed to oppose, such as expanding nuclear power. The present study thus adds more nuance to our understanding of public opinion about climate mitigation strategies by examining framing effects on support for specific policies. We pose the following research question:

RQ1. Do the nature of framing effects among political partisans vary based on the policy option proposed?

1.2. Understanding the processing mechanism: simple heuristic or motivated cognition?

There are at least two potential processing mechanisms via which a climate change frame may polarize public opinion. The first possibility is that "climate change" serves as a simple heuristic that activates partisan schema and engages miserly processing (Lau and Redlawsk, 2001). People are inherently cognitive misers, meaning that they are limited in their capacity to process information and thus strive to make decisions as quickly and efficiently as possible (Taylor, 1981). In a political context, one way individuals do this is by employing cognitive short-cuts, or heuristics; for example, using candidates' party identification to decide whether or not to support them (Lau and Redlawsk, 2001; Popkin, 1991). Given that mitigation policies are complex and citizens often lack adequate knowledge to evaluate policies (Delli Carpini and Keeter, 1996), a heuristic can simplify the decision-making process. Specifically, if climate change serves as a marker of Democrat vs. Republican partisan identity, its use as a policy frame may lead individuals to accept or reject the policy on the basis of their partisanship. Republicans, for example, would quickly reject the policy if it is attached to climate change, whereas Democrats would immediately accept it. In this case, the climate change frame functions as an up-down cue, which prompts partisans to register their support for a policy with little mental effort or attention to the content of the policy itself (Downs, 1957). If climate change indeed functions as a simple heuristic, its use as a frame should minimize processing time when registering a policy opinion, relative to other frames (Eagly and Chaiken, 1993; Petersen et al., 2013). We formalize this possibility with the following hypothesis:

H2. Policy opinions will be registered more quickly in response to the climate change frame, relative to other frames.

A second possibility is that individuals evaluate the policy information in an effortful manner, using the frame to inform their perceptions of the policy's relative benefits and costs, which in turn drive their overall opinion. Here, the climate change frame does not function as a heuristic. Rather, the meaning with which the frame is imbued triggers motivated reasoning (Taber and Lodge, 2006), priming partisans to process policy content – such as its perceived benefits and costs – in a way that is consistent with their party's position on climate change.

Motivated reasoning is a process by which individuals interpret and respond to new information in a way that protects their existing beliefs or affiliations (Kunda, 1990; Taber and Lodge, 2006). Partisan motivated reasoning is driven by the interaction of affect and cognition (Redlawsk, 2002), or what Taber and Lodge (2006) call "hot cognitions," which is the idea that all sociopolitical concepts (like "climate change") have an affective charge stored in memory and this affective evaluation automatically biases information processing in defense of our prior commitments. Similarly, research in risk and decision-making has found that people form judgments of an object or activity based on how they feel about it, using their positive or negative emotional reaction to guide their perceptions of its social consequences (Slovic et al., 2007). Drawing from this concept, the cultural cognition thesis further proposes that people's affective reactions to risk information will vary on the basis of their worldviews or values and motivate information processing that is consistent with those values (Kahan et al., 2017). Prior research offers abundant evidence for motivated reasoning in response to information about climate change (e.g., Hart and Nisbet, 2012; Kahan et al., 2012; Nisbet et al., 2015).

Motivated cognition is considered an effortful – not heuristic – process, as individuals invest effort to come up with reasons for why their desired conclusion is correct (Kunda, 1990; Petersen et al., 2013). For example, Cohen (2003) found that political party endorsements – by triggering a process of motivated reasoning – shape policy perceptions, even overwhelming the influence of the ideological content of the policy itself. According to Cohen, the endorsement contains social meaning that signals whether a policy is compatible with shared values, and it is this shift in social meaning – not heuristic processing – that drives opinion. In support of this, Cohen found that the effect of party cues on policy attitudes was mediated by the valence of systematic processing (e.g., individuals' thoughts about a policy were positively biased when endorsed by their own party).

In the present context, the climate change frame would be expected to work similarly, cueing individuals to see the policy as more or less compatible with the values of their group and to process the content of the policy accordingly. Thus, as with the previous heuristic explanation, the "climate change" frame signals an association with partisan identity; however, in the presence of motivated reasoning, the frame does not reduce effort but rather colors how the policy is interpreted. In other words, the frame – in interaction with partisanship – will bias the direction of systematic processing of policy content, which, in turn will drive overall opinion. As a proxy for the valence of processing, we focus here on the policy's perceived relative benefits and costs, which prior research has shown is a key predictor of support for climate and energy policy (e.g., Stoutenborough et al., 2013; Tobler et al., 2012; Truelove, 2012) and a mediator of framing effects on policy opinions (Clarke et al., 2015; Nisbet et al., 2013).

The climate change frame, because it connects a proposed policy to a polarized partisan identity, is expected to trigger a biased interpretation of the policy's relative benefits and costs. We predict that the other frames, which are less polarizing, will produce less divergence in partisans' perceptions of relative benefits and costs. If the hypothesized framing effects work through a process of motivated cognition, the effects of the frame on policy support should be mediated by perceptions of benefits and costs and *not* heuristic processing. To test this possibility, we propose the following two hypotheses:

H3. Framing will interact with partisan identity to influence a policy's perceived benefits versus costs. Republicans' [Democrats'] perceptions of a policy's relative benefits vs. costs will be lower [higher] when the policy is framed as a solution to climate change compared to when it is framed as a solution to air pollution or energy dependence.

H4. Perceived benefits vs. costs will mediate the effects of framing on policy support, conditional on party identification.

While we position heuristic processing and motivated reasoning as alternative mechanisms, we recognize that both may be operating to some degree among different individuals. For example, the climate change frame may be more likely to trigger motivated reasoning among individuals who are more politically sophisticated and have stronger attitudes (Taber and Lodge, 2006), whereas the climate frame may

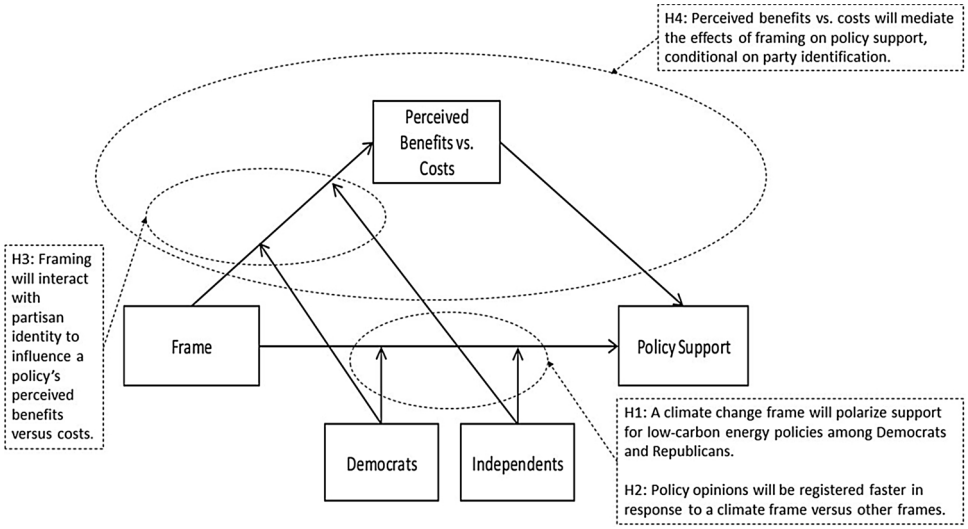
H4: Perceived benefits vs. costs will mediate the effects of framing on policy support, conditional on party identification.
Perceived Benefits vs. Costs
H3: Framing will interact with partisan identity to influence a policy's perceived benefits versus costs.
Frame
Policy Support
Democrats
Independents
H1: A climate change frame will polarize support for low-carbon energy policies among Democrats and Republicans.
H2: Policy opinions will be registered faster in response to a climate frame versus other frames.

Fig. 1. Summary of hypotheses.

function as a heuristic for less sophisticated or extreme audiences. Although testing these potential conditional effects are beyond the scope of the present study, our hypotheses allow for the possibility that both processes are operating to some degree. Fig. 1 presents a graphic overview of the hypotheses.

2. Methods

We conducted an online survey experiment administered to a nationally representative U.S. sample of 1000 respondents recruited from YouGov between August 25, 2017 and September 22, 2017. YouGov uses a sample matching procedure to approximate a random sample (Rivers, 2007). For this study, YouGov drew a stratified random sample of respondents from the 2010 American Community Study and then matched members from its opt-in online panel to this target sample based on gender, age, race, education, party identification, ideology, and political interest. The final sample was 54% female, 76% white, with a mean age of 47.4 (SD = 16.8). Median education was "some college," and median income was $40,000-$49,999.

The study used a 3 (*benefit frame*: climate change, air pollution, energy security) x 4 (*policy*: carbon tax, fuel efficiency standards, renewable energy, nuclear power) mixed factorial design. Frame was manipulated between participants using random assignment. Policy was manipulated within participants, with all participants receiving questions about all four policies.

The policies – a revenue-neutral carbon tax, tougher fuel efficiency standards, increased government investment in renewable energy, and expansion of nuclear power – were selected based on polling results that show that they vary both in their degree of overall public support and in their pattern of partisan differences. Specifically, more than 80% of Americans support the development of renewable energy sources (Leiserowitz et al., 2016) and stricter fuel efficiency standards for automobiles (Pew Research Center, 2014); however, in both cases, Republicans tend to be less supportive than Democrats. In contrast, a slight majority of Americans oppose the expansion of nuclear power, although it is favored by more Republicans than Democrats (Pew Research Center, 2014; Riffkin, 2016). A revenue-neutral carbon tax is supported by more than two-thirds of Americans (Leiserowitz et al., 2016); although Republicans are less supportive than Democrats, the proposal has been explicitly championed by former high-level Republican officials (Schwartz, 2017), and other research has found that emissions-reduction policies that use market incentives, such as carbon pricing, are more acceptable across political parties (Stoutenborough et al., 2014). Additionally, all four policies are aimed at reducing fossil fuel use and thus offer solutions to climate change, as well as to air pollution and foreign oil dependence; thus, all three frames were relevant to all four policies (Walker et al., 2017).

After consenting to participate, respondents were shown the following statement: "We are interested in your opinions about several possible energy policies that have been proposed by legislators as a way to help [reduce greenhouse gas emissions and stop climate change/reduce air pollution and its related health effects/reduce U.S. dependence on foreign sources of oil]. The following questions will ask you about your opinions on these policies." The assigned frame was reinforced in subsequent survey questions about each of the four policies.

For each policy, respondents answered questions about their support for the policy and its perceived costs and benefits, as well as several measures not used in the present study, including perceived policy effectiveness and perceived public opinion. Respondents then moved onto questions about the next policy. The same set of questions was repeated for each policy, and the order of policies was randomized across respondents. The survey took an average of seven minutes to complete.

2.1. Measures

Policy support was measured by asking respondents, "How much do you support or oppose the following policy as a way to help [reduce greenhouse gas emissions and stop climate change / reduce air pollution and its related health effects / reduce U.S. dependence on foreign sources of oil]?" The four policies were described as follows: (1) "Requiring fossil fuel companies to pay a tax on carbon emissions and using the money to reduce Americans' taxes by an equal amount;" (2) "Imposing tougher fuel efficiency standards for automobiles and trucks;" (3) "Increasing government investment in renewable energy such as wind and solar;" and (4) "Expanding the use of nuclear power plantsto generate electricity." Support was registered on a 7-point scale ranging from 1 "strongly oppose" to 7 "strongly support," and including 4 "neither support nor oppose" as a midpoint (tax: M = 4.6, SD = 1.9; fuel: M = 4.8, SD = 2.0; renewables: M = 5.3, SD = 1.9; nuclear: M = 4.0, SD = 1.9).

To assess *heuristic processing* during opinion formation, we measured response latencies for the policy support questions; that is, the time interval between seeing the question and selecting a response. Response latency has been used in both laboratory (Redlawsk, 2002; Taber and Lodge, 2006) and online (Bolsen et al., 2014; Petersen et al., 2013) settings as an indicator of processing effort. The key advantage of response latency as an indicator of heuristic processing is that it allows for

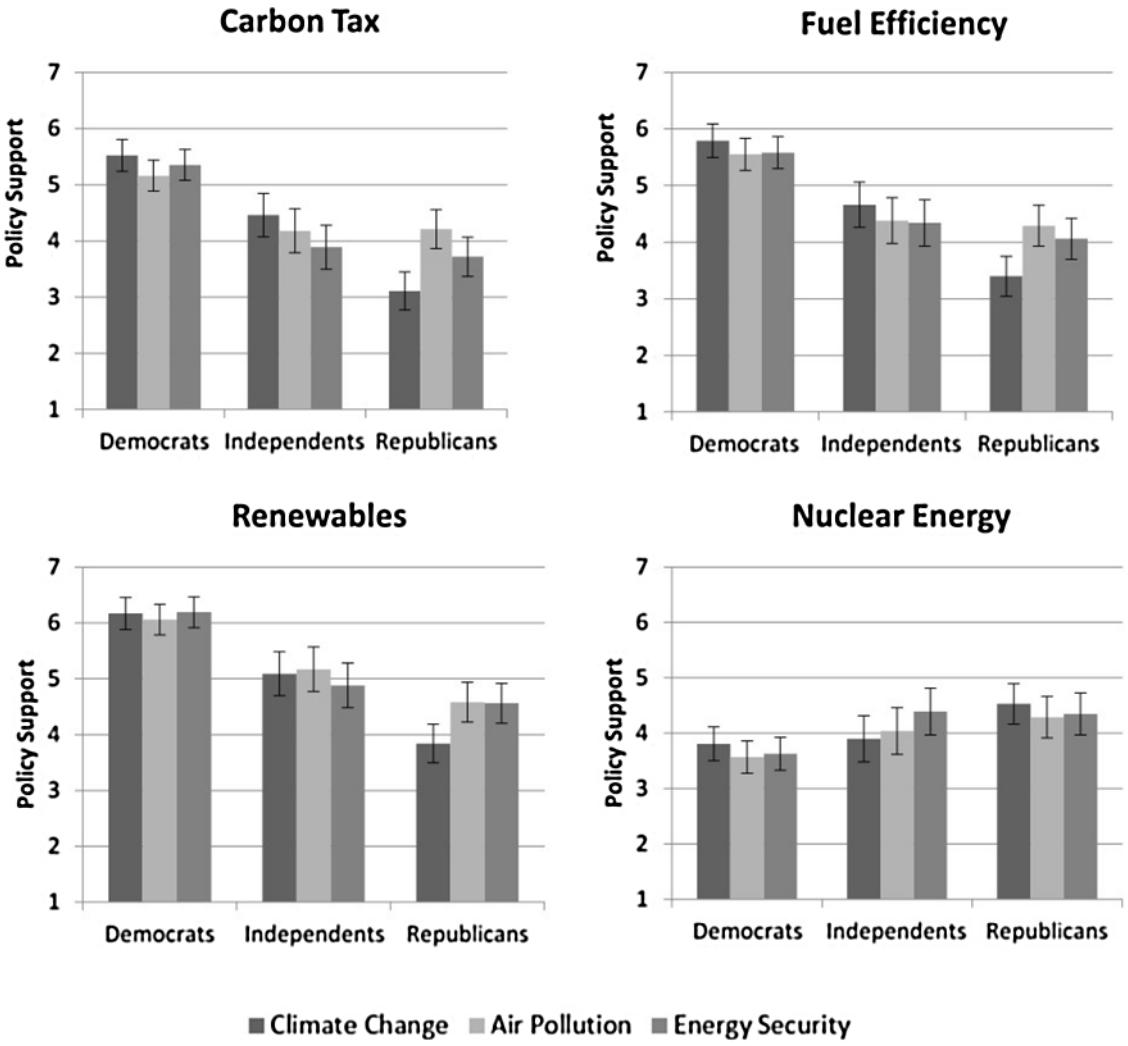

Fig. 2. Estimated means for policy support by framing condition and party identification, with 95% Cis.

a parsimonious, unobtrusive measure of processing effort during opinion formation, rather than relying on participants' post-hoc self-report (e.g., Griffin et al., 2002), which may be inaccurate and/or biased by social desirability concerns (Burdein et al., 2006; Petersen et al., 2013). Following prior research (Bolsen et al., 2014; Huckfeldt et al., 1999; Nelson et al., 1997), we used a logged measure of response latency (i.e., logged milliseconds) to reduce positive skew in the data (tax: $M = 9.32$, $SD = 0.94$; fuel: $M = 9.05$, $SD = 0.84$; renewables: $M = 8.95$, $SD = 0.84$; nuclear: $M = 8.90$, $SD = 0.85$).

Perceived benefits vs. costs was measured subsequent to the policy support question using three items. First, respondents were instructed to "think again about the proposed policy to reduce [climate change/air pollution/dependence on foreign oil] by [policy description (see policy support variable for precise language)]." The first item asked respondents "How costly to society do you think this policy is?" (1 = not at all costly, 5 = extremely costly). The second item asked "How beneficial to society do you think this policy is?" (1 = not at all beneficial, 5 = extremely beneficial). The third item asked "When considering this policy, do you think the benefits outweigh the costs, or the costs outweigh the benefits?" (1 = costs strongly outweigh the benefits, 5 = benefits strongly outweigh the costs). After reverse-coding the "costly" item, responses to the three items were averaged to compute a scale of perceived benefits versus costs for each policy, where high values correspond to high perceived benefits and low perceived costs and low values correspond to low perceived benefits and high perceived costs (tax: *Cronbach's* $\alpha = 0.80$, $M = 3.0$, $SD = 1.1$; fuel: $\alpha = 0.78$, $M = 3.2$, $SD = 1.0$; renewables: $\alpha = 0.80$, $M = 3.4$, $SD = 1.1$; nuclear: $\alpha = 0.76$, $M = 2.8$, $SD = 1.0$).

A measure of respondents' *party identification* was provided by YouGov as part of its core panel profile items. Respondents were initially asked whether they identify as "Republican," "Democrat," "Independent," "Other," or "Not sure." Those who did not choose either Republican or Democrat were then asked whether they "lean Republican," "lean Democrat," or "neither." For the purpose of analysis, party identification was recoded into a three-category variable that grouped together Republicans and Republican leaners ($n = 299$, 23.5%); Democrats and Democrat leaners ($n = 466$, 46.6%); and those identifying as Independents, Other, or Not Sure ($n = 235$, 23.5%). The decision to group leaners with party identifiers follows prior research that finds that leaners behave like partisans (Greene, 1999; Petrocik, 2009).

3. Results

To test the direct effects of the framing manipulation and its interaction with party identification on policy support, response latencies, and perceived benefits vs. costs, we used repeated measures ANOVA, where policy was treated as a within-subject variable, and frame and party identification were treated as between-subject variables. All pairwise tests of significant differences were conducted using the Sidak adjustment for multiple comparisons.

The results for policy support showed a main effect for policy type

(Greenhouse-Geisser adjusted F (2.29, 2243.03) = 75.45, $p < .001$; $\eta^2 = 0.06$), such that overall mean support was highest for renewables ($M = 5.17$, $SE = 0.06$), followed, in order, by fuel efficiency ($M = 4.67$, $SE = 0.06$), carbon tax ($M = 4.40$, $SE = 0.06$), and nuclear energy ($M = 4.06$, $SE = 0.06$), with significant differences between all four policies (all $p < .01$).There also was an overall effect of partisanship (F (2, 979) = 96.09, $p < .001$; $\eta^2 = 0.16$), such that, when averaged across policies, Democrats were most supportive ($M = 5.20$, $SE = 0.05$), followed by Independents ($M = 4.45$, $SE = 0.07$) and Republicans ($M = 4.08$, $SE = 0.06$), with significant differences between all three groups (all $p < .01$). However, partisans varied in their level of support between policies (Greenhouse-Geisser adjusted F (4.58, 2243.03) = 54.21, $p < .001$; $\eta^2 = 0.09$); whereas Democrats were significantly more supportive than Republicans and Independents of the carbon tax, fuel efficiency, and renewables (all $p < .001$), Democrats were *less* supportive of nuclear energy than Republicans ($p < .001$) and Independents ($p < .05$) (see Appendix Table A1 for the estimated means for policy support across partisan groups and policies).

Turning to a test of *H1*, the results for policy support show a significant interaction between frame and party identification (F (4, 979) = 4.97, $p < .001$; $\eta^2 = 0.02$). Averaged across all four policies, Republicans exhibit lower levels of support in the climate change ($M = 3.72$, $SE = 0.11$) condition than in the air pollution ($M = 4.34$, $SE = 0.06$; $p < .001$) and energy security ($M = 4.17$, $SE = 0.06$; $p < .05$) conditions. There were no significant differences between conditions for Democrats or Independents (see Appendix Table A1). Additionally, addressing RQ1, a significant three-way interaction (Greenhouse-Geisser adjusted F (9.16, 2243.03) = 2.38, $p < .05$; $\eta^2 = 0.008$) indicated that the framing effects among Republicans were restricted to the carbon tax, fuel, and renewables policies; Republicans did not exhibit any significant differences across frames when it came to their support for nuclear energy (see Fig. 2).

Next, we used repeated measures ANOVA to test the effects of the manipulation on logged response latencies in order to determine whether the climate change frame triggered heuristic processing (*H2*). There was no main effect of the framing manipulation (F (2, 979) = 0.06, $p = .94$; $\eta^2 = 0.0001$); nor did it interact with partisanship (F (4, 979) = 0.81, $p = .52$; $\eta^2 = 0.003$) (see Appendix Table A2 for estimated means across conditions). However, the interaction between frame and policy approached significance (Greenhouse-Geisser adjusted F (5.92, 2897.70) = 1.82, $p < .10$; $\eta^2 = 0.003$). Probing this interaction showed a simple effect of the frame manipulation for nuclear policy only (F (2, 979) = 2.56, $p < .08$; $\eta^2 = 0.005$); here, the climate change frame produced marginally slower reaction times ($M = 9.08$, $SE = 0.05$) than the energy security frame ($M = 8.94$, $SE = 0.05$; $p < .10$). The difference between the climate change frame and the pollution frame ($M = 8.96$, $SE = 0.05$) was not significant ($p = .24$). There were no significant or near-significant framing effects for the other three policies (see Fig. 3 for a plot of the policy by frame interaction). The three-way interaction between frame, policy, and partisanship was not significant (Greenhouse-Geisser adjusted F (11.84, 2897.70) = 0.42, $p = .95$).

The results for logged response latencies also showed a significant main effect of partisanship (F (2, 979) = 5.99, $p < .01$; $\eta^2 = 0.01$); overall, Republicans ($M = 9.19$, $SE = 0.04$) had significantly slower response times than Democrats ($M = 9.07$, $SE = 0.03$; $p < .05$) and Independents ($M = 8.99$, $SE = 0.04$; $p < .01$). The difference between Democrats and Independents was not statistically significant ($p = .44$). There also was a significant main effect of policy (Greenhouse-Geisser adjusted F (2.96, 2897.70) = 62.23, $p < .001$; $\eta^2 = 0.06$). Overall, response times were significantly slower for carbon tax ($M = 9.32$, $SE = 0.03$) than fuel efficiency ($M = 9.05$, $SE = 0.03$), renewables ($M = 8.96$, $SE = 0.03$), and nuclear energy ($M = 8.99$, $SE = 0.03$; all $p < .001$). We note, however, that these differences may, in part, be an artifact of the slightly longer word count for the carbon tax policy (i.e., people may have taken longer to read this policy and respond relative to the other policies). Response latencies for fuel efficiency also were significantly slower than for renewables ($p < .01$). When using a measure of ranked (instead of logged) response latencies (Petersen et al., 2013) – where the fastest response time is assigned the lowest value, the second fastest the second lowest value, and so on – there was no effect of policy (Greenhouse-Geisser adjusted F (2.97, 2909.82) = 0.24, $p = .87$; $\eta^2 = 0.0002$). Other results were relatively unchanged using this alternative transformation.

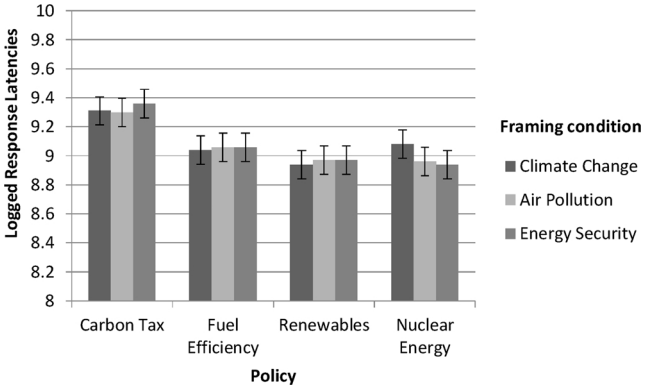

Fig. 3. Estimated mean logged response latencies by framing condition and policy with 95% Cis.

Turning now to perceived benefits versus costs, the pattern of results was similar to what we found for policy support. There was a main effect of policy (Greenhouse-Geisser adjusted F (2.30, 2284.44) = 51.79, $p < .001$; $\eta^2 = 0.04$), such that perceived relative benefits were highest for renewables ($M = 3.26$, $SE = 0.03$), followed, in order, by fuel efficiency ($M = 3.08$, $SE = 0.03$), carbon tax ($M = 2.91$, $SE = 0.03$), and nuclear energy ($M = 2.79$, $SE = 0.03$); all policies were significantly different from one another ($p < .001$), except the difference between carbon tax and nuclear ($p = .07$) 0.07). There also was an overall effect of partisanship (F (2, 991) = 184.24, $p < .001$; $\eta^2 = 0.19$), such that Democrats ($M = 3.39$, $SE = 0.03$) perceived the greatest benefits vs. costs of the proposed policies, overall, followed by Independents ($M = 2.94$, $SE = 0.03$) and then Republicans ($M = 2.70$, $SE = 0.03$), with significant differences between all three groups (all $p < .001$). However, partisans varied between policies in their perceived benefits vs. costs (Greenhouse-Geisser adjusted F (4.61, 2284.44) = 55.87, $p < .001$; $\eta^2 = 0.10$): Democrats perceived significantly greater relative benefits than Republicans and Independents for carbon tax, fuel efficiency, and renewables (all $p < .001$), whereas Democrats saw nuclear energy as less beneficial than Republicans ($p < .001$) and Independents, although the latter difference was not significant ($p = .13$) (see Appendix Table A3 for estimated means across conditions).

The main effect of frame on perceived relative benefits vs. costs approached significance (F (2, 991) = 2.81, $p = .06$; $\eta^2 = 0.004$). Overall, the climate frame ($M = 2.94$, $SE = 0.03$) resulted in marginally lower perceived relative benefits when compared to the energy security frame ($M = 3.06$, $SE = 0.04$; $p = .06$). The interaction between frame and policy also approached significance (Greenhouse-Geisser adjusted F (4.61, 2284.44) = 1.49, $p = .07$; $\eta^2 = 0.004$); for nuclear policy only, the energy security frame ($M = 2.92$, $SE = 0.06$) resulted in higher perceived benefits than the air pollution frame ($M = 2.69$, $SE = 0.06$; $p < .05$). Further, consistent with *H3*, there was a significant interaction between frame and party identification (F (4, 991) = 5.45, $p < .001$; $\eta^2 = 0.02$). Averaged across all four policies, Republicans perceived lower relative benefits in the climate change condition ($M = 2.46$, $SE = 0.06$) than in the air pollution ($M = 2.80$, $SE = 0.06$) and energy security ($M = 2.83$, $SE = 0.06$) conditions (both $p < .001$). There were no significant differences between conditions for Democrats or Independents. A significant three-way interaction (Greenhouse-Geisser adjusted F (9.22, 2284.44) = 2.08,

$p < .05$; $\eta^2 = 0.007$) indicated that the framing effects among Republicans were restricted to the carbon tax, fuel, and renewables policies; Republicans did not exhibit any significant differences across frames for nuclear energy (see Fig. 4). Pairwise comparisons also revealed that Independents perceived greater relative benefits for nuclear energy in the energy security condition than in the climate condition ($p < .05$). Democrats did not exhibit any framing effects, regardless of policy.

Finally, we used the SPSS PROCESS macro to test the indirect effects of the framing treatment on policy support via perceived benefits vs. costs, conditional on partisanship (*H4*). PROCESS provides OLS regression coefficients as well as bootstrapped confidence intervals for the indirect effects. As a test of mediation, bootstrap methods, which do not assume normality, are considered superior to alternatives such as the Sobel test or causal steps approach (Hayes, 2013). The bootstrap analysis was conducted with 10,000 iterations and bias-corrected estimates. Because the ANOVAs revealed significant interactions between frame and partisanship on both perceived benefits vs. costs and policy support, we accounted for these interactions in our model by using PROCESS Model 10, conducted separately for each policy (see Fig. 1).[1] The analyses controlled for age, race, sex, and education.[2]

The regression results predicting perceived costs and benefits were consistent with the ANOVA results reported above and are thus not discussed further (see Appendix Table A4). Regression results predicting policy support showed that perceived benefits vs. costs is a significant, positive predictor of support for each of the four policies (see Table 1). Further, as shown by the significant indirect effects in Table 2, perceived benefits vs. costs mediated the framing effects among Republicans on support for the tax, fuel efficiency, and renewables policies. Perceived benefits vs. costs also mediated the effect among Independents of the energy frame (relative to the climate frame) on support for nuclear policy. In other words, the air pollution and energy frames increased policy support indirectly, through its effects on perceived benefits vs. costs.

4. Discussion

The primary objective of this study was to experimentally examine how different ways of framing the benefits of four specific clean energy policies affect U.S. public support for those policies, and how these effects may be moderated by political partisanship. We expected that linking policies to climate change would have a more polarizing effect on public opinion than if policies are instead positioned as solutions to air pollution or energy dependence. As hypothesized, we found that climate change was the most polarizing of the three frames, producing the widest differences in policy support between Republicans and Democrats. However, significant framing effects on policy support were isolated among Republicans. Republicans were less supportive of low-carbon energy policies when they were framed as a solution to climate change than when they were framed as a solution to energy security or air pollution. Democrats' level of policy support was unaffected by a shift in framing, although the trend was toward higher levels of support in the climate change condition.

These findings suggest that altering the justification for clean energy policy from climate change – which has been hotly contested along partisan lines – to something that is more consistent with Republican values can increase support for climate-friendly policies, including investment in renewable energy, a revenue-neutral carbon tax, and regulations on fuel efficiency. Although the results are consistent with the idea that the climate change frame activates partisan schema, which, in turn, function as a filter through which Republicans interpret policy information, future research could more explicitly test this theory by measuring the accessibility of partisan attitudes or salience of identity following exposure to a climate change frame. Future research also should continue to probe the interaction between climate change and partisan identity; for example, to understand how identity salience or the presence of explicit elite party cues may moderate framing effects.

The finding that framing effects were isolated among Republicans is consistent with prior research (e.g., Stokes and Warshaw, 2017); however, it is still notable that Democrats were not influenced at all by the framing manipulation. There are several possible explanations for this. For one, Democrats may have more fixed opinions than Republicans when it comes to energy policy and thus be relatively impervious to framing effects. Indeed, prior research shows that Democrats are more responsive to policy content, versus external cues, than Republicans (Bullock, 2011). This might be particularly true given that our framing manipulation involved only a small change in question wording. A stronger manipulation may have had larger effects. A second possibility is that Democrats did not see much difference between benefit frames; that is, they may find climate change, air pollution, and energy security roughly equally compelling as reasons for policy action. Yet another possible explanation is that Democrats – due to their relative concern about climate change – may be chronically primed to think about climate change in the context of clean energy policies and are thus unaffected by a frame that makes this connection explicit. Future research is needed to sort through these various possibilities.

Another important finding is that framing effects among Republicans were observed for all policies *except* expansion of nuclear power. Thus, the nature of framing effects is dependent on policy content. Given that of the four policies tested, nuclear is the one for which Republicans registered the highest levels of support, this suggests that framing is less important for policies that Republicans are predisposed to support. An explanation for this is suggested by Campbell and Kay (2014), who found that it is Republicans' aversion to the regulatory solutions typically proposed for climate change that makes them skeptical of climate change science; Republicans are more accepting of climate science when a Republican-friendly policy is offered as a solution. Extrapolating to the present context, this may suggest that Republicans are less sensitive to the polarizing cue of the climate change frame when the solution being proposed is affirming rather than threatening to Republican identity. More generally, given both that Republicans resisted the frame when considering nuclear policy and that Democrats were invulnerable to framing effects across the board, suggest that partisans may be more responsive to the ideological content of energy policies than to framing per se.

This study also contributes to our understanding of the processing mechanism via which the climate change frame polarizes public opinion. To this end, we found no evidence that the climate change frame functions as a simple heuristic: The climate frame did not reduce processing effort – measured as response latencies – relative to the other frames. In fact, Republicans, who exhibited the strongest framing effects, had the slowest response times overall, indicating that they expended more cognitive effort than Democrats and Independents when registering their support for energy policies. Thus, rather than prompting a heuristic process, our evidence instead suggests that, at least among Republicans, framing facilitates a process of motivated cognition, whereby the climate frame – by connecting a proposed policy to a polarized partisan identity – encourages biased processing

[1] PROCESS assumes either a binary or continuous independent variable. Because our independent variable (frame) is multi-categorical, in order to obtain estimates of the conditional indirect effects for both the energy security and air pollution frames (relative to the climate frame), we ran two PROCESS analyses so that the effects of each of the dummy-coded framing conditions could be tested as the independent variable (see Hayes and Preacher, 2014). Each model included the other non-climate change frame as a control. Dummy variables representing Democrats and Independents were included as moderators, with Republicans as the reference category.

[2] Given that there were no framing effects on response latencies, we did not include this as a mediator in the final results reported in the text. However, we did test an alternative model that include logged response latencies as a second parallel mediator. Although slower response times were positively related to policy support ($p < .01$ for carbon tax, fuel efficiency, and renewables; $p = .34$ for nuclear), there were no indirect effects via response times, and the estimated indirect effects via perceived benefits vs. costs were largely unchanged.

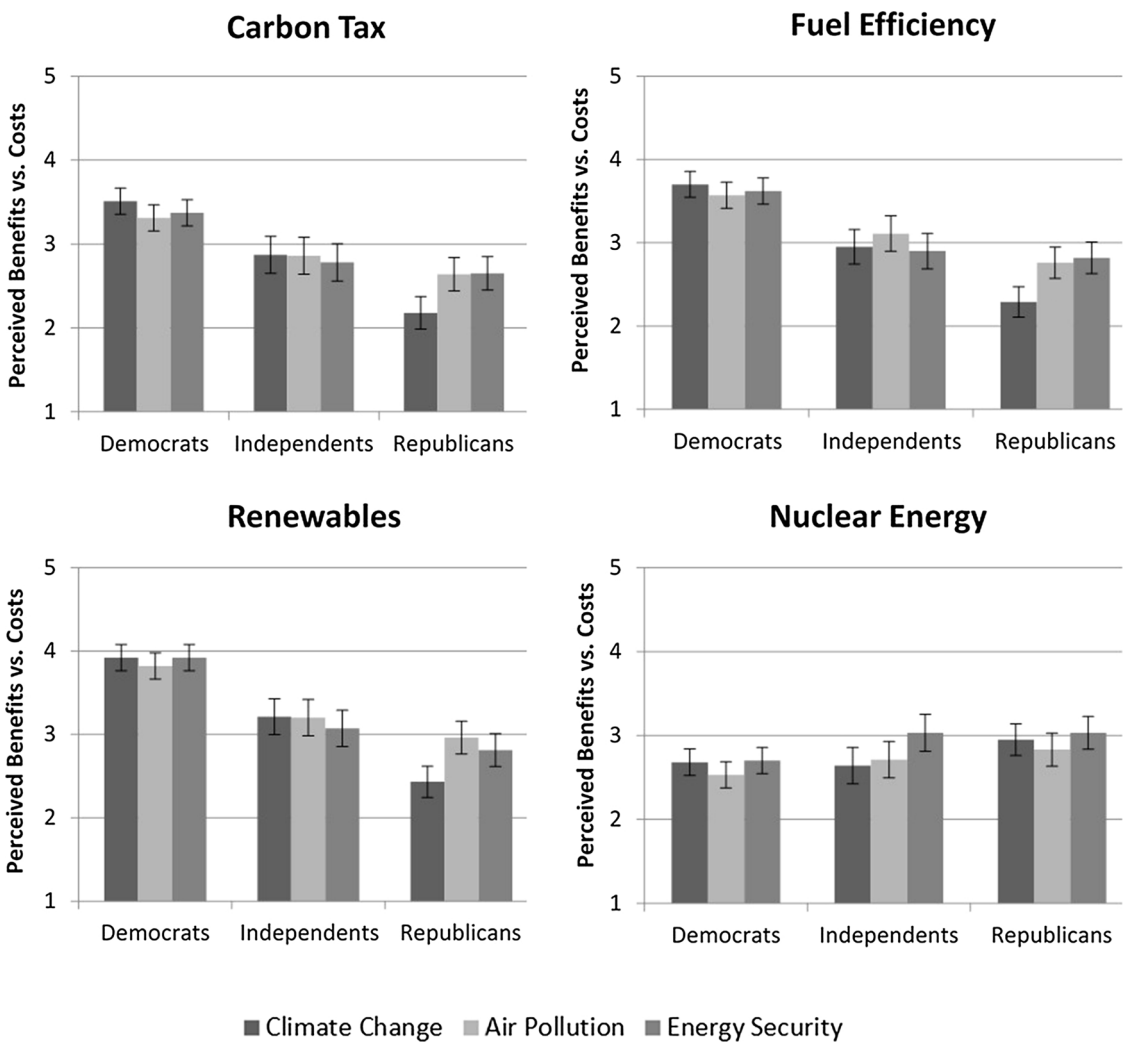

Fig. 4. Estimated means for perceived benefits vs. costs by framing condition and party identification, with 95% Cis.

of policy content. In support of this idea, we found that the effects of framing on policy support among Republicans were mediated by perceptions of the policy's relative benefits and costs.

The response time analysis also showed that the climate change frame marginally increased processing effort relative to the other frames for nuclear policy only. This is likely because framing nuclear energy as a solution for climate change creates cognitive dissonance among both Republicans and Democrats by pairing a desirable benefit with an undesirable solution, or vice versa. It seems that partisans reconcile these conflicting cues by more carefully deliberating about the merits of the policy. Although this result should be interpreted tentatively, given the marginal effects, it is consistent with prior research that finds the presence of incongruent information induces reasoning effort (Huckfeldt et al., 1999; Redlawsk, 2002). The lack of framing effects for nuclear policy across all partisan groups further suggests that in the face of dissonance, policy content overwhelms the framing cue. Nonetheless, understanding how audiences resolve dissonance between policy content and frame content offers an important avenue for future research.

Several limitations of the present study should be kept in mind. First, the frame was induced through a question wording manipulation; framing effects may have been stronger if we had used a more developed message, such as a news article. However, our goal in this study was to measure framing effects in the cleanest way possible, without confounding the frame with other message elements (Cacciatore et al., 2016). Similarly, we provided only a brief statement of each policy; evidence for motivated processing of policy content may have been more acute if respondents had been given detailed information about the policies' risks and benefits. We also recognize that we measured perceived benefits and costs after policy support; while this may undermine our assumptions about the direction of causality between these two variables, it is still consistent with a process of motivated cognition, whereby partisans come up with reasons to support their desired conclusion (Kunda, 1990). Additionally, we are limited in that we did not use a no-frame control condition; thus, we are only able to compare the effects of the frames relative to one another and thus can't draw conclusions about how they compare to a context in which no explicit benefit of a proposed policy is offered. We also did not test the effects of

Table 1
OLS Regression Results Predicting Policy Support.

	Policy			
	Carbon Tax	Fuel Efficiency	Renewables	Nuclear Energy
Frame[a]				
Energy Frame	0.03 (0.18)	−0.07 (0.18)	0.16 (0.17)	−0.23 (0.20)
Pollution Frame	0.52 (0.18)**	0.20 (0.18)	−0.04 (0.17)	−0.07 (0.20)
Partisanship[b]				
Democrats	0.85 (0.17)***	0.49 (0.17)**	0.31 (0.16)	−0.25 (0.18)
Independents	0.50 (0.19)**	0.36 (0.19)+	0.16 (0.18)	−0.09 (0.21)
Frame x Partisanship Interactions				
Energy x Democrats	−0.05 (0.23)	−0.02 (0.23)	−0.15 (0.21)	0.02 (0.25)
Energy x Independents	−0.45 (0.27)	−0.08 (0.27)	−0.10 (0.25)	0.23 (0.30)
Pollution x Democrats	−0.67 (0.23)**	−0.26 (0.23)	0.07 (0.21)	−0.002 (0.25)
Pollution x Independents	−0.77 (0.27)**	−0.65 (0.27)*	0.18 (0.25)	0.10 (0.30)
Perceived Benefits vs. Costs	1.18 (0.04)***	1.38 (0.04)***	1.36 (0.04)***	1.30 (0.05)***
Controls				
Age	0.004 (0.002)	0.004 (0.002)+	0.004 (0.002)+	0.01 (0.003)*
Male	−0.19 (0.08)*	−0.18 (0.08)*	−0.07 (0.07)	0.06 (0.09)
White	−0.004 (0.10)	0.22 (0.09)*	0.23 (0.09)*	0.17 (0.10)
Education	−0.02 (0.03)	0.05 (0.03)+	−0.01 (0.02)	0.03 (0.03)
Constant	0.51 (0.25)*	−0.24 (0.24)	0.22 (0.23)	0.03 (0.27)
R^2	0.56	0.61	0.64	0.48
N	996	995	1000	997

Note. Unstandardized regression coefficients are reported.
[a] Climate change is the reference category.
[b] Republicans are the reference category.
*** $p < .001$.
** $p < .01$.
* $p < .05$.
+ $p < .10$.

Table 2
Conditional Indirect Effects of Framing on Policy Support through Perceived Benefits vs. Costs.

	Policy							
	Carbon Tax		Fuel Efficiency		Renewables		Nuclear Energy	
	Effect (Boot SE)	Boot 95% CI	Effect (Boot SE)	Boot 95% CI	Effect (Boot SE)	Boot 95% CI	Effect (Boot SE)	Boot 95% CI
Republicans								
Air Pollution Frame[a]	**0.48 (0.16)**	**0.17, 0.80**	**0.62 (0.20)**	**0.24, 1.01**	**0.67 (0.21)**	**0.26, 1.07**	−0.11 (0.19)	−0.48, 0.25
Energy Frame[a]	**0.47 (0.16)**	**0.15, 0.78**	**0.70 (0.20)**	**0.31, 1.10**	**0.46 (0.21)**	**0.05, 0.88**	0.12 (0.17)	−0.21, 0.46
Independents								
Air Pollution Frame[a]	−0.06 (0.19)	−0.44, 0.32	0.23 (0.22)	−0.21, 0.68	−0.03 (0.23)	−0.48, 0.44	0.11 (0.19)	−0.26, 0.49
Energy Frame[a]	−0.14 (0.20)	−0.54, 0.26	−0.05 (0.23)	−0.50, 0.39	−0.16 (0.24)	−0.62, 0.31	**0.50 (0.19)**	**0.12, 0.89**
Democrats								
Air Pollution Frame[a]	−0.23 (.13)	−0.49, 0.02	−0.15 (0.13)	−0.41, 0.10	−0.12 (0.13)	−0.37, 0.13	−0.15 (0.15)	−0.43, 0.15
Energy Frame[a]	−0.12 (0.12)	−0.37, 0.13	−0.08 (0.13)	−0.35, 0.17	0.04 (0.13)	−0.21, 0.29	0.03 (0.14)	−0.25, 0.32

Note. Bootstrapped standard errors and confidence intervals were computed using 10,000 bootstrap samples. Bold font is used to denote significant effects, $p < 0.05$.
[a] Relative to the Climate Change Frame.

counter-frames, which may limit the influences observed here (see Aklin and Urpelainen, 2013). Future research should test the effects of alternative benefit framing on support for specific policies in a competitive information environment and ideally in a field setting that captures the real-world dynamics of framing and public opinion. Finally, we recognize that the noisiness of the response latency data (Fazio, 1990) may have made it more difficult to detect effects using these measures.

Additionally, our available measures do not allow us to determine whether the observed effects of political party persist after controlling

for respondents' pre-exposure beliefs about the problem posed by climate change, air pollution, and energy support, respectively. It is possible that it is concern about the problem reflected in the frame, and not political party affiliation per se, that explains the effects on policy support. This remains an important question for future research. Similarly, it is possible that there are belief-based antecedents to political party identification that help explain the observed effects. One particularly fruitful direction for future research would be to replicate the analyses reported here using cultural worldviews (Kahan et al., 2012, 2017; Wildavsky, 1987) instead of party identification. This would offer a more generalizable finding that may apply more readily to countries that have party systems and alliances different from and less polarized than those in the U.S.

Ultimately, this research contributes to a better understanding of public opinion about specific clean energy policies and its vulnerability to framing effects. In the context of public opinion polling, the findings suggest that the frames used to qualify different policy options have measurable effects on participants' responses and specifically that question wording that links policies to climate change may understate support among Republicans. Moreover, this study has important implications for whether and under what conditions communication practitioners should explicitly link clean energy policies to climate change, or whether they should instead emphasize improved health and energy security as alternative benefits of policy action. On their face, our findings suggest that strategic messages designed to promote support for clean energy and climate mitigation polices would reduce opinion polarization and more effectively engage Republican audiences if the messages did not overtly mention climate change. However, this may come at an ultimate cost to climate action. Marginalizing climate change from public discourse may reduce the public salience of the issue and implicitly communicate lack of faith in the scientific evidence for climate change (Vezirgiannidou, 2013). Indeed, recent political directives to avoid mention of "climate change" seem to be aimed at obfuscating climate science and protecting fossil fuel interests (Milman, 2017). To instead promote climate-friendly policies, a more effective communication approach may be to design messages that prioritize alternative benefits of clean energy without completely excluding discussion of climate change (e.g., see Walker et al., 2017). As the impacts of climate change continue to intensify, ongoing efforts in research and practice to reduce the polarizing impact of climate change communication and advance clean energy goals have never been more critical.

Declaration of interests

None.

Acknowledgments

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Appendix A

Table A1
Estimated Marginal Means for Policy Support Across Frame and Party Identification.

	Frame			
	Climate Change	Air Pollution	Energy Security	Overall
Carbon Tax				
Democrats	5.52 (0.14)	5.16 (0.14)	5.35 (0.14)	5.34 (0.08)
Independents	4.46 (0.20)	4.18 (0.20)	3.89 (0.20)	4.18 (0.11)
Republicans	$3.11\ (0.17)_a$	$4.21\ (0.18)_b$	$3.72\ (0.18)_b$	3.68 (0.10)
Overall	4.36 (0.10)	4.52 (0.10)	4.32 (0.10)	4.40 (0.06)
Fuel Efficiency				
Democrats	5.79 (0.15)	5.55 (0.14)	5.58 (0.14)	5.64 (0.08)
Independents	4.66 (0.20)	4.38 (0.21)	4.34 (0.21)	4.46 (0.12)
Republicans	$3.40\ (0.18)_a$	$4.29\ (0.19)_b$	$4.06\ (0.18)_b$	3.92 (0.11)
Overall	4.62 (0.10)	4.74 (0.10)	4.66 (0.10)	4.67 (0.06)
Renewables				
Democrats	6.17 (0.15)	6.06 (0.14)	6.19 (0.14)	6.14 (0.08)
Independents	5.09 (0.20)	5.17 (0.20)	4.88 (0.20)	5.05 (0.12)
Republicans	$3.84\ (0.18)_a$	$4.58\ (0.18)_b$	$4.56\ (0.18)_b$	4.33 (0.10)
Overall	5.03 (.10)	5.27 (.10)	5.21 (.10)	5.17 (.06)
Nuclear Energy				
Democrats	3.81 (0.16)	3.57 (0.15)	3.63 (0.15)	3.68 (0.09)
Independents	3.90 (0.21)	4.04 (0.21)	4.39 (0.22)	4.11 (0.12)
Republicans	4.53 (0.19)	4.29 (0.19)	4.35 (0.19)	4.39 (0.11)
Overall	4.08 (0.11)	3.97 (0.11)	4.13 (0.11)	4.06 (0.06)
Total				
Democrats	5.32 (0.09)	5.08 (0.09)	5.19 (0.09)	5.20 (0.05)
Independents	4.52 (0.13)	4.44 (0.13)	4.38 (0.13)	4.45 (0.07)
Republicans	$3.72\ (.11)_a$	$4.34\ (0.11)_b$	$4.17\ (0.11)_b$	4.08 (0.06)
Overall	4.52 (.06)	4.62 (.06)	4.58 (.06)	4.57 (.04)

Note. Standard errors in parentheses. Within rows, means with different subscript are significantly different from one another, $p < .05$ after the Sidak adjustment.

Table A2
Estimated Marginal Means for Logged Response Latencies Across Frame and Party Identification.

	Frame			
	Climate Change	Air Pollution	Energy Security	Overall
Carbon Tax				
Democrats	9.26 (0.08)	9.36 (0.07)	9.32 (0.07)	9.31 (0.04)
Independents	9.27 (0.10)	9.09 (0.11)	9.33 (0.11)	9.23 (0.06)
Republicans	9.40 (0.09)	9.45 (0.09)	9.43 (0.09)	9.42 (0.05)
Overall	9.31 (0.05)	9.30 (0.05)	9.36 (0.05)	9.32 (0.03)
Fuel Efficiency				
Democrats	8.98 (0.07)	9.10 (0.07)	9.04 (0.07)	9.04 (0.04)
Independents	9.02 (0.09)	8.91 (0.09)	9.03 (0.09)	8.99 (0.05)
Republicans	9.14 (0.08)	9.16 (0.08)	9.12 (0.08)	9.14 (0.05)
Overall	9.04 (0.05)	9.06 (0.05)	9.06 (0.05)	9.05 (0.03)
Renewables				
Democrats	8.91 (0.07)	8.90 (0.07)	8.91 (0.07)	8.91 (0.04)
Independents	8.85 (0.09)	8.83 (0.09)	8.87 (0.10)	8.85 (0.05)
Republicans	9.05 (0.08)	9.19 (0.08)	9.11 (0.08)	9.12 (0.05)
Overall	8.94 (0.05)	8.97 (0.05)	8.97 (0.05)	8.96 (0.03)
Nuclear Energy				
Democrats	9.06 (0.07)	9.04 (0.07)	8.92 (0.07)	9.00 (0.04)
Independents	9.04 (0.09)	8.78 (0.10)	8.91 (0.10)	8.91 (0.05)
Republicans	9.15 (0.08)	9.08 (0.09)	8.98 (0.09)	9.07 (0.05)
Overall	9.08 (0.05)	8.96 (0.05)	8.94 (0.05)	8.99 (0.03)
Total				
Democrats	9.05 (0.05)	9.10 (0.05)	9.05 (0.05)	9.07 (0.03)
Independents	9.04 (0.07)	8.90 (0.08)	9.03 (0.08)	8.99 (0.04)
Republicans	9.18 (0.07)	9.22 (0.07)	9.16 (0.07)	9.19 (0.04)
Overall	9.09 (0.04)	9.07 (0.04)	9.08 (0.04)	9.08 (0.02)

Note. Standard errors in parentheses. Within rows, there were no significant pairwise differences.

Table A3
Estimated Marginal Means for Perceived Benefits and Costs Across Frame and Party Identification.

	Frame			
	Climate Change	Air Pollution	Energy Security	Overall
Carbon Tax				
Democrats	3.51 (0.08)	3.31 (0.08)	3.37 (0.08)	3.40 (0.05)
Independents	2.87 (0.11)	2.86 (0.11)	2.78 (0.11)	2.83 (0.07)
Republicans	$2.18\ (0.10)_{a}$	$2.64\ (0.10)_{b}$	$2.65\ (0.10)_{b}$	2.49 (0.06)
Overall	2.85 (0.06)	2.93 (0.06)	2.94 (0.06)	2.91 (0.03)
Fuel Efficiency				
Democrats	3.70 (0.08)	3.57 (0.07)	3.62 (0.07)	3.63 (0.04)
Independents	2.95 (0.11)	3.11 (0.11)	2.90 (0.11)	2.98 (0.06)
Republicans	$2.29\ (0.09)_{a}$	$2.76\ (0.10)_{b}$	$2.82\ (0.10)_{b}$	2.63 (0.05)
Overall	2.98 (0.05)	3.14 (0.05)	3.11 (0.05)	3.08 (0.03)
Renewables				
Democrats	3.92 (0.08)	3.82 (0.08)	3.92 (0.08)	3.89 (0.05)
Independents	3.21 (0.11)	3.20 (0.11)	3.07 (0.11)	3.16 (0.06)
Republicans	$2.64\ (0.11)_{a}$	$2.96\ (0.10)_{b}$	$2.81\ (0.18)_{b}$	2.73 (0.06)
Overall	3.19 (0.06)	3.33 (0.06)	3.27 (0.06)	3.26 (0.03)
Nuclear Energy				
Democrats	2.68 (0.08)	2.53 (0.08)	2.70 (0.08)	2.63 (0.04)
Independents	$2.64\ (0.11)_{a}$	$2.71\ (0.11)_{a,b}$	$3.03\ (.11)_{b}$	2.79 (0.06)
Republicans	2.95 (0.10)	2.83 (0.10)	3.03 (0.10)	2.93 (0.06)
Overall	$2.76\ (0.05)_{a,b}$	$2.69\ (0.06)_{a}$	$2.92\ (0.06)_{b}$	2.79 (0.03)
Total				
Democrats	3.45 (0.05)	3.31 (0.05)	3.40 (0.05)	3.39 (0.03)
Independents	2.92 (0.07)	2.97 (0.06)	2.94 (0.07)	2.94 (0.04)
Republicans	$2.46\ (0.06)_{a}$	$2.80\ (0.06)_{b}$	$2.83\ (0.06)_{b}$	2.70 (0.04)
Overall	2.94 (0.03)	3.02 (0.04)	3.06 (0.04)	3.01 (0.02)

Note. Standard errors in parentheses. Within rows, means with different subscript are significantly different from one another, $p < .05$ after the Sidak adjustment.

Table A4
OLS Regression Results Predicting Perceived Benefits and Costs.

	Policy			
	Carbon Tax	Fuel Efficiency	Renewables	Nuclear Energy
Frame[a]				
Energy Frame	0.40 (0.14)**	0.51 (0.13)***	0.34 (0.14)*	0.10 (0.14)
Pollution Frame	0.40 (0.14)***	0.45 (0.14)***	0.49 (0.14)***	−0.09 (0.14)
Partisanship[b]				
Democrats	1.20 (0.13)***	1.34 (0.12)***	1.41 (0.12)***	−0.27 (0.13)*
Independents	0.59 (0.15)***	0.61 (0.14)***	0.70 (0.14)***	−0.39 (0.14)*
Frame x Partisanship Interactions				
Energy x Democrats	−0.50 (0.18)**	−0.57 (0.17)**	−0.31 (0.18)+	−0.07 (0.18)
Energy x Independents	−0.51 (0.21)*	−0.55 (0.21)**	−0.46 (0.21)*	0.28 (0.21)
Pollution x Democrats	−0.60 (0.18)***	−0.56 (0.17)**	−0.58 (0.18)**	−0.03 (0.18)
Pollution x Independents	−0.46 (0.21)*	−0.28 (0.20)	−0.51 (0.21)*	−0.17 (0.21)
Controls				
Age	−0.01 (0.002)***	−0.005 (0.002)**	−0.008 (0.002)***	−0.004 (0.002)*
Male	−0.23 (0.06)***	−0.01 (0.06)	−0.16 (0.06)*	0.35 (0.06)***
White	−0.003 (0.07)	0.003 (0.07)	0.09 (0.07)	0.05 (0.07)
Education	−0.02 (0.02)	0.06 (0.02)	0.03 (0.02)	0.02 (0.02)
Constant	2.95 (0.17)***	2.35 (0.17)***	2.80 (0.17)***	2.86 (0.17)***
R^2	0.19	0.21	0.25	0.06
N	996	995	1000	997

Note. Unstandardized regression coefficients are reported.
[a] Climate change is the reference category.
[b] Republicans are the reference category.
*** $p < .001$.
** $p < .01$.
* $p < .05$.
+ $p < .10$.

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